USING OCULOMETRICS FOR COGNITIVE TASK ANALYSIS

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BACKGROUND

One element of a legally defensible job analysis is the inclusion of a thorough task analysis, or the examination of discrete tasks required of the job (Brown, 1996). However, in today's knowledge economy, how a job analyst gains access to tasks carried out by knowledge workers (e.g., accountants, computer programmers, etc.) is obfuscated by the constraint that an individual interacting with a computer presents. In traditional, manual labor jobs, assessing tasks conducted allowed for recording of observable, discrete units of work such as chopping and lifting. The interface with a worker and his/her computer prohibits a job analyst to get a clear picture of the work for at least three reasons: 1) the speed of the work, 2) integrated systems, 3) undefined analytical processes. Thus, the goal of the present effort is to evaluate how the use of eye-tracking and screen capture technologies impact observation and analysis of the cognitive tasks conducted by knowledge workers.

RESEARCH QUESTION

How can eye-tracking and screen capture (i.e. oculometric) technologies impact observation and analysis of the cognitive tasks conducted by knowledge workers?

METHODOLOGY

Phase 1: Survey:

- 2 parts:
  - Worker preferences, opinions, and backgrounds
  - Worker perceptions of information and systems required to complete work
- Purposes:
  - Capture individual differences between worker experience and perceptions
  - Capture individual perceptions of knowledge processes required to complete the work

Phase 2: Scenario Eye-Tracking:

- Static images of company systems were organized into a "logical" work process (or scenario)
- Purposes:
  - Sample a wide array of potential work processes
  - Evaluate visual attention required to complete the tasks
  - Identify specific pieces of information required to solve problems
  - Controlled environment removed typical work and technological distractions

Phase 3: VPN Eye-Tracking

- Two portions: (1) prompted, (2) unprompted
- Purposes:
  - Capture a range of work processes across a range of worker experience levels
  - Capture individual differences in knowledge processes and task completion in a live, uncontrolled environment

Phase 4: Eye-Tracking Interview

- Semi-structured, 1 on 1 interviews conducted while reviewing the VPN eye-tracking recording
- Purposes:
  - Acquire verbal confirmation of the conclusions drawn from eye-tracking and screen capture recordings
  - Increase researcher understanding of work being completed

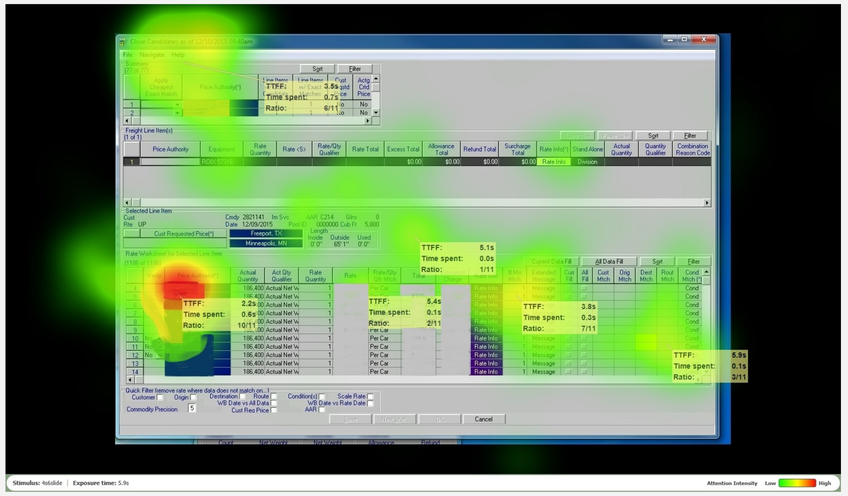
DATA AND RESULTS

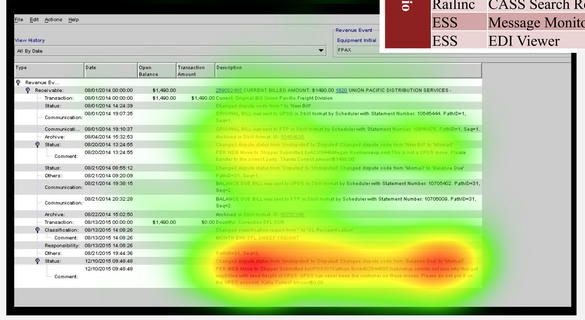
Phase 1: Survey

> "While working in shipment, if I need to go to waybill to make a correction, once the comment box pops open I cannot go back to shipment to get info I may need for the comment. I have to write stuff down before I go there or go out and start over to find that info if I forget." - Study Participant

System	Chronological Order Participants Visited Each System in Scenario 1										Total Responses
	1	2	3	4	5	6	7	8	9	10	
RSP	14	3	0	0	0	1	0	0	0	0	18
ARMS	1	4	3	2	2	3	2	1	0	0	18
ESS	0	4	8	3	2	1	0	0	0	0	18
Gensis	0	0	0	4	5	3	1	2	3	0	18
Railinc	1	4	5	2	5	0	1	0	0	0	18
TPX Mainframe	1	2	2	6	2	4	0	1	0	0	18
Customer Master	1	0	0	0	1	1	10	1	4	0	18
AOW	0	1	0	0	0	3	4	9	0	1	18
FTM	0	0	0	1	0	2	0	2	11	2	18
Other	0	0	0	0	1	0	0	2	0	15	18
Total	18	18	18	18	18	18	18	18	18	18	

Phase 2: Scenario Eye-Tracking





Dispute Resolution Scenario

System	Screen	Avg. Exposure Time (Sec)	Information Used
RSP	MVMT Waybill	14	Movement information, route type, revenue information
RSP	Customer	6.4	Customers: customer, customer role; Customer Master information
RSP	Comments	3.5	Four keys (top of screen)
RSP	History	6.7	Related objects: all; changes and events: scattered
RSP	History	4	Changes and events
RSP	History	4.9	Changes and events
RSP	Waybill Search	12	Lead waybill date, movement origin, movement destination
RSP	Select Like	8.8	Account, commodity, customer (look-up), movement information: origin, dest
Railinc	CASS Search Results	12.6	Event time, location
ESS	Message Monitor	10	Origin city, destination city
ESS	EDI Viewer	12.4	Inbound: lines N9 to N1-N4 loop

Phase 3: VPN Eye-Tracking

Phase 4: Eye-Tracking Interview

Please refer to the computer screen next to this poster for visualization of the data collected.

CONCLUSIONS

HCIP Model Significance:

- x Information Interface
- x Information Handling
- x Mental Plan and Schedule
- ☐ Mental Execution
- x Monitor
- x Communication
- x Learning
- x Attention
- x Memory
- x Motivation
- x Environment

Based on our findings, eye-tracking and screen capture technologies can be utilized in this four-phase methodology to accurately extract the knowledge, skills, and abilities required to complete knowledge work. This methodology also goes further to identify specific information needed to complete the work.

RECOMMENDATIONS

- Modify the methodology to the cognitive task being performed
- Begin each eye-tracking cognitive task analysis with a traditional job analytic survey
- Utilize eye-tracking technologies in two stages to capture both controlled and uncontrolled responses

KEY REFERENCES

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